Instructions on Completing Mock-Up of Track Slide Design for Lift/Lower of Center-Mounted Footrests on Power Wheel Chairs

by **rantista** on April 13, 2009

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intro: Instructions on Completing Mock-Up of Track Slide Design for Lift/Lower of Center-Mounted Footrests on Power Wheel Chairs

Center-mounted footrests lift to be stowed beneath the seat well, and lower to be deployed. A mechanism for independent operation of footrest stowage and deployment is not included in market power wheel chairs, and PWC users have expressed the need for such a mechanism. We aim to design a solution that permits wheelchair users to independently lift and lower a center-mounted footplate during transferring processes.

The mock-up is designed to showcase the mechanism by which the track slide design works to lift and lower the power wheelchair center-mounted footrest. The instructables for this design will most likely require access to a machine shop. **Bolding indicates important instructions.**

link to youtube video demonstrating use, and uses of several other designs:
http://www.youtube.com/watch?v=5ks2oms2GBs

step 1: Procuring Materials

Start off with a simple drawer slide, the drawer slide must allow you to remove the track from the slide. The innate locking mechanism of the track may also be useful to showcase a locking mechanism (Fig 1). You will also want to pick up hinges of all different sizes. I used 4 different hinges, 3 of which were rather large ACE brand long hinges, and one small miniature hinge. You will also need screws, washers, bolts, bushings, and spare aluminum parts. The size of which is up to you, as you will be drilling the holes at a size of your individual discretion. I will make suggestions on size at times, but it is up to you. These are the essential materials. Other materials are also needed later for retrofitting onto the wheelchair and for ergonomic considerations.

List of Materials (All materials will be pictured in latter steps)

Essential device materials
drawer slide (shown in Fig 1)
3 long hinges
1 miniature sized hinge
screws, washers, bolts, bushings
aluminum scrap piece for making a handle bar

Retrofitting/Ergonomic nonessential materials
8020 construction set piece
foam
zip ties
L-bar

Fig 1: Sample Drawer Slide (I used a silver one)

Fig 2: Locking mechanism of the drawer slide. The silver bolt stops the track inset

step 2: Adjusting Track Slide length

The final outcome (**1st image**) is shown in this step to give you an idea of what you are eventually going to end up with, and also help elucidate some of the reasoning and steps along the way.

The first real step of construction is now upon us. First, the track slide may need to be cut down to size (less than 14 inches between base of footrest and seat bottom) in order to fit most power wheel chairs (**Refer to final outcome pic, 1st image** for better idea of where the device rests). Do this with a hacksaw.

To cut the track slide, you will need to cut both the track base and the track inset separately.

Terminology (Fig 3, 2nd Image)

track slide will refer to the drawer slide
track base will refer to the non-mobile base portion of the drawer slide
track inset will refer to the mobile inset portion of the drawer slide

After cutting the track base and inset, you may have to recreate the original locking mechanism. **Fig 4, 3rd Image**. showcases what I did compared to the original locking mechanism. What I did was drill two holes as the stopper for the ball bearings slide, and drill a hole and use a bolt as the new catch. This only works because the excess metal from the drill hole protrudes and acts like the original stopper bolts/protrusions.

Fig 3. Track slide, with track inset fully extended. (Terminology) **Track inset is the detachable mobile portion on the right. Track base is the portion on the left. Both pieces comprise the track slide.**

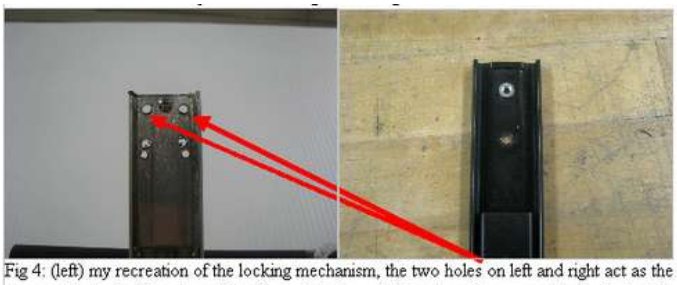


Fig 4: (left) my recreation of the locking mechanism, the two holes on left and right act as the stopper for the ball bearings slide. The bolt in the middle acts as the new catch for the locking mechanism. (right) original locking mechanism on track. Try to replicate original lock structure.

step 3: Creating a Hinged Track Slide

The track inset will need to be cut again. This time, the cut is made, so that when the track inset travels up the track baseand reaches the catch-lock (shown in Fig 4, 3rd Image of Step 2), it does not extend past the seat well (bottom underside of seat). Place the track slide, vertically, near the base of the footrest, and extend the track inset up, from the track base until it locks into the base's locking mechanism (mentioned in step 2). The track inset may travel above the plane of the seat well, and would interfere with transfer. Measure the point at which the track inset travels above the plane of the seat well, you will want to cut at this point (**See 1st Image**).

The track inset can be cut via tthe hacksaw.

Now you need to connect the two cut pieces with a hinge. Find a small hinge, as shown in **Fig 5, 2nd Image**.

Locate holes on both pieces of the track inset to drill, of appropriate size. Make sure the track inset pieces line up, drill holes, and use rivets to secure the hinge. You will need to file down the rivets.

Final result is shown in Fig 5, 2nd Image. I used .125 in sized rivets, and a .133 in sized drill bit for drilling into the track inset.

Before I continue with the next stops of modifying your track slide w/ hinged track inset, I want to show the final result, and steps 4-6 will detail how to do one portion, **outlined below in Fig 6, 3rd Image.**

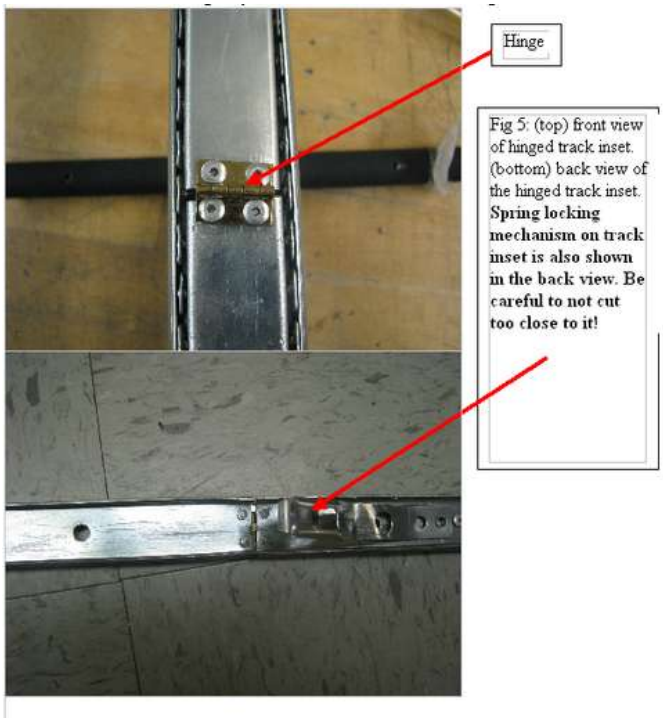
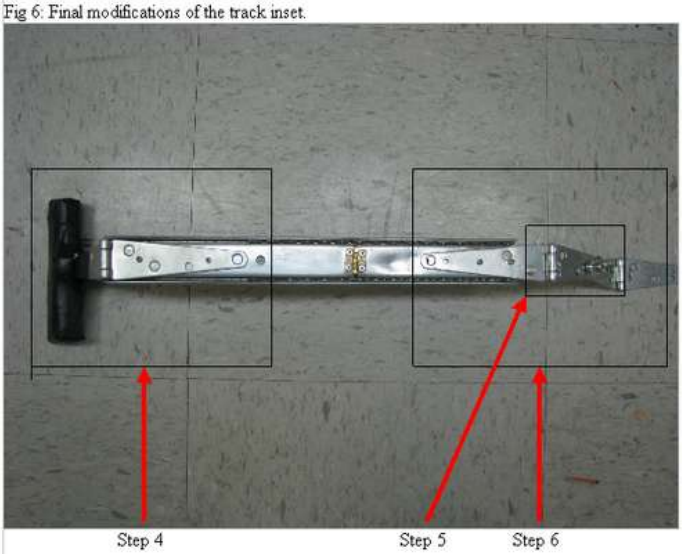


Fig 5: (top) front view of hinged track inset. (bottom) back view of the hinged track inset. **Spring locking mechanism on track inset is also shown in the back view. Be careful to not cut too close to it!**

Fig 6: Final modifications of the track inset.



step 4: Creating the Handle

The handle will be attached to the longer piece of the hinged two-part track inset from step 3. You may want to consider using a long hinge, **such as shown in Fig 7, Image**.

You attach one portion of the hinge to the track inset via rivets (two drilled holes of appropriate sizes), or screws. Once again, my rivets were .125 in, with .133 drill bits.

The other side of the hinge can now be fitted with whatever handle design you would like. I bolted on a piece of spare aluminum and covered it in foam tape for a T-handle.

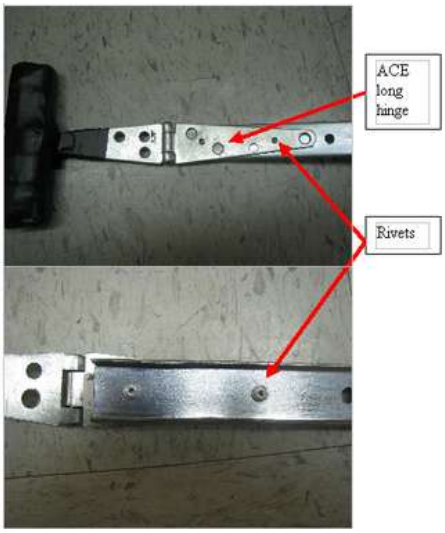


Fig 7: (top) front view of handle attachment to track inset. The handle consisted of a long ACE hinge, with the handle side of the hinge screwed to an aluminum strip and wrapped in black foam.
(bottom) back view of handle attachment to track inset.

step 5: Creating the Slotted Footrest Moment Arm

Now we must create the actual attachment from the track to the footrest. This will require two relatively long hinges.

I have labeled them as A and B in figure 8, 1st Image

First, find a long hinge(A) that is at least as long as your chosen moment arm length. Based on the length of the moment arm (of your choosing), you may need to cut one side of the hinge down. (*If you don't want to deal with the physics for moment arm calculations, just find a hinge around a 4.5 inch length.*) For my mock-up, I left it at 4.5 inches **(Fig 8, 1st Image)**. '

Next, you will need to create the slotting mechanism. ***This mechanism increases your moment arm length, during lift, as well, so this must be taken into account for optimization.***

Find a set of small bushings. These will be used as your rollers in your slot. Take your hinge, and use the mill to create a slot of width dependent on the diameter of your bushings (use calipers). **See Fig 9, 2nd Image**. You must make many passes with the mill and use lubrication, because the hinge material is steel.

Third, take your second hinge (B), and you must attach the bushing rollers to this hinge.

The bushings must either be cut or filed down to the height of the thickness of the hinge A. **Please see Fig 9, 2nd Image for reference**. Find two bolts which fit within the inner holes of the two bushings. Drill holes corresponding to bolt size through the hinge (B). The distance between these two holes also dictates how much extension your moment arm will have. You may want to consider drilling more holes for testing purposes.

Now fit both bolts through the holes in hinge B, then the bushings, and finally through the slot of hinge A (Fig 9, 2nd Image). Make sure that the bushings move and roll easily within the slot and creates an extension motion.

Lock in the bushings now with washers and wing nuts/nuts/locknuts.

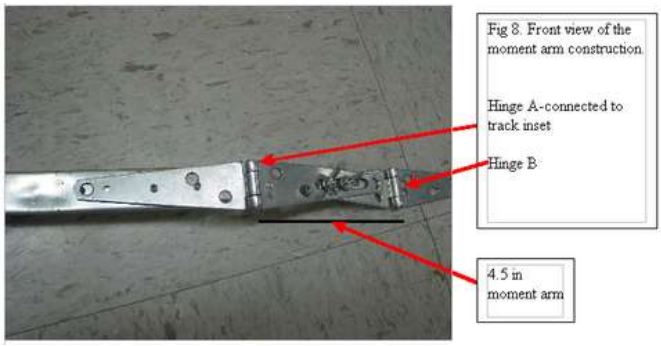


Fig 8. Front view of the moment arm construction.

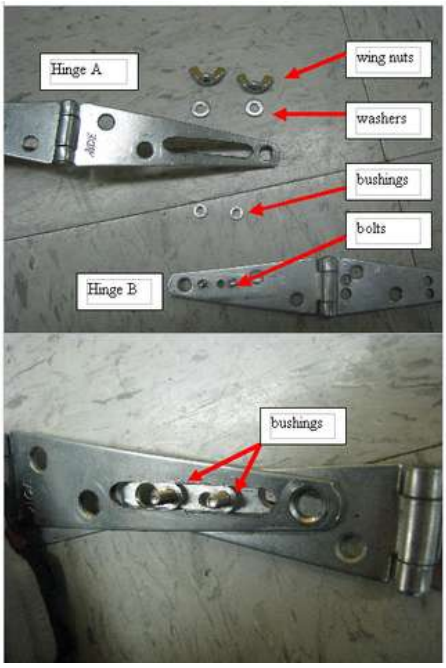


Fig 9. (top) exploded view of slotted moment arm construction. (bottom) close-up view of bushing rollers and showcasing same thickness of bushings to hinge (A)

step 6: Attaching the Moment Arm to the Track Slide

Attach hinge A from the moment arm, step 5, to the track slide with rivets. '

Drill two holes in both the track inset and hinge A and use rivets to secure. ***Once again, you may have to file down the rivets. The hinge may be attached below the bottom of the track slide,*** *see Fig 10, Image****. This is done because most footrests actually have a dip, and this allows to moment arm to sit flat on the footrest.***

Fig 10: (top) Front view of attachment of Hinge A of moment arm to track inset. (bottom) Back view of attachment of Hinge A of moment arm to

step 7: Checkpoint: End of Essential Device Construction

Check point: At this point, the construction of the device is complete. It should look like the Image

step 8: Attachment to the PWC

Attachment to any PWC design is fairly straightforward with this design.

On the back of the track slide, you can drill two or three holes directly in the center, and put bolts through. This will allow you to connect L connectors or other retrofit apparatus, see Fig 11, 1st Image.

Using the L bracket, you can now attach to PWC via the footrest height adjustment.

First, find a piece of 8020 which looks like Fig 12, 2nd Image. We will refer to this as the 8020 connector. You can use the two holes on its side and bolt it into the footrest height adjust. **This is shown in Fig 12, 2nd Image**

Now we can attach the track slide design to the PWC via the 8020 connector piece.

Use a long bolt and bolt the L bracket of the track slide to the 8020 connector piece. Secure it with a nut. This process is shown in Fig 13, 3rd Image.

Tightening the bolts should lock the track slide in place to the PWC height adjust.

Now you must attach the track slide to the footrest itself.

Attach hinge B from the moment arm to the footrest with either zip ties or bolting it through the actual footrest, shown in Fig 14, 4th Image. You can also use larger rivets.

Fig 11: (top) front view of track, with ball bearing slide moved to show placement of holes. (bottom) back view of track, with L bracket attached via bolts and nuts.

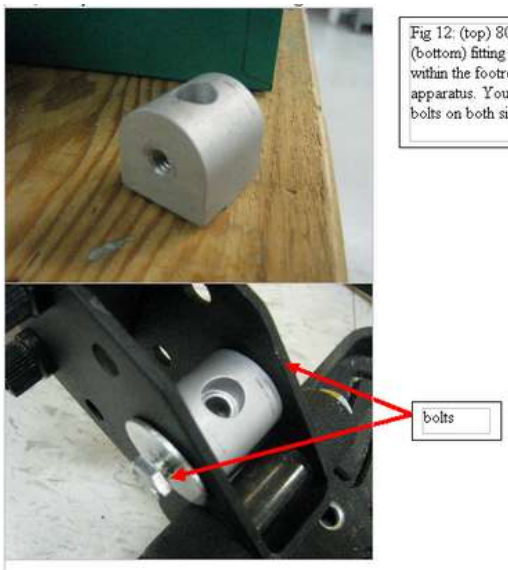


Fig 12: (top) 8020 connector (bottom) fitting the 8020 connector within the footrest height adjustment apparatus. You can secure it in via bolts on both sides.

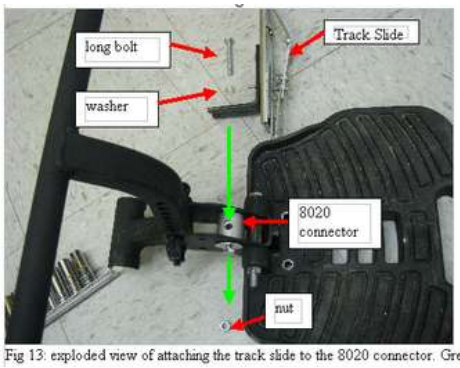


Fig 13: exploded view of attaching the track slide to the 8020 connector. Green arrows represent the bolting action.


Fig 14. Attachment of Hinge B of moment arm to footrest

step 9: Finished

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Comments

1 comments **Add Comment**

kelseymh says: Apr 14, 2009. 7:46 AM **REPLY**

Very nicely documented and complete! This should be sufficient for anyone to actually follow and replicate. Definitely worth being Featured.

I've added it to the Assistive Technology group here at I'bles along with the other recent center-mount footrest I'ble.